MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2019/2020

DET5078 – ANALOG ELECTRONICS 2

(Diploma in Electronics Engineering)

9 MARCH 2020
2:30 PM – 4:30 PM
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **6** pages excluding the cover page with **4** questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the answer booklet provided.

QUESTION 1 [25 marks]

(a) Draw the design structure of an n-channel JFET and explain its operation in detail. (11 marks)

(b) Figure 1 shows a high frequency amplifier circuit for Field Effect Transistor.

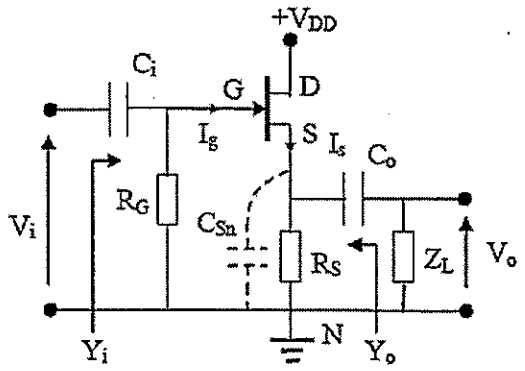

Figure 1

(i) Explain the Miller theorem and state its purpose. (4 marks)

(ii) Sketch the high frequency model from Figure 1 after applying Miller's theorem. (4 marks)

(c) Explain in details of the following amplifier noise:

(i) Thermal Noise (3 marks)

(ii) Shot Noise (3 marks)

Continued ...

QUESTION 2 [25 marks]

(a) Briefly explain ALL types of the power amplifiers classification and draw its output waveform respectively. (12 marks)

(b) Explain the purpose of the power amplifier. (2 marks)

(c) Sketch the output waveform between the astable, monostable and bistable multivibrators. Briefly explain the concept of the stable output states of these multivibrators. (6 marks)

(d) Describe the relationship between the input and output of a Schmitt Trigger circuit with the aid of a proper waveform. (5 marks)

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QUESTION 3 [25 marks]

(a) Figure 2 below shows a self-biased configuration circuit of a FET transistor.

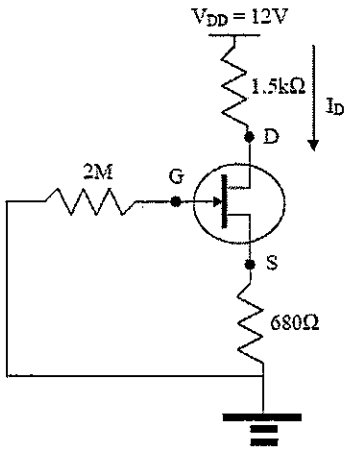

Figure 2

Given maximum drain current, I_{DSS} is 12 mA and pinch-off voltage, V_P is -6 V, determine the following values:

(i) V_{GSQ} and I_{DQ} (7 marks)

(ii) V_D and V_S (4 marks)

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(b) Figure 3 shows a high frequency common drain amplifier circuit for FET.

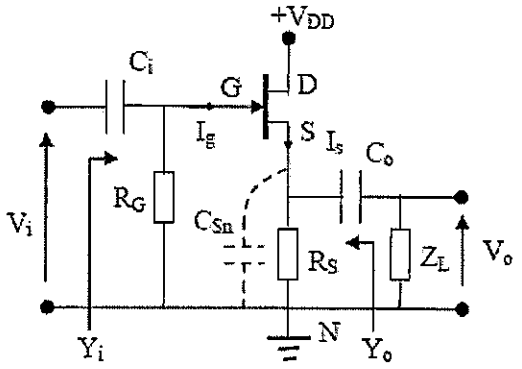

Figure 3

The circuit has a $R_G = 1\ \text{M}\Omega$, $R_S = 100\ \text{k}\Omega$, $Z_L = 10\ \text{k}\Omega$ and it can operate up to 35 kHz. The coupling capacitors have large values of capacitance. The other parameters are $g_m = 5\ \text{mA/V}$, $r_d = 50\ \text{k}\Omega$, $C_{gs} = 3\ \text{pF}$, $C_{ds} = C_{gd} = 1\ \text{pF}$.
Assume $C_{Sn} = 1\ \text{pF}$.

Determine the following:

(i) Identify the type of the amplifier in Figure 3 (1 mark)

(ii) $|A_v|$ (5.5 marks)

(iii) Y_A (3 marks)

(iv) Z_i (4.5 marks)

Hint:

$G = 1/R$, $Y = j\omega C$, $g = 1/r$ $Y = 1/Z$

$Y_A = Y(1 - A_v)$, $Y_B = Y(1 - 1/A_v)$, $Y_i = G_G + Y_{gd} + Y_A$

$$A_V = \frac{g_m + Y_{gs}}{Y_{gs} + g_m + g_d + Y_{ds} + Y_{Sn} + G_S + Y_L}$$

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QUESTION 4 [25 marks]

(a) For the operating power amplifier circuit as shown in Figure 4, answer the following:

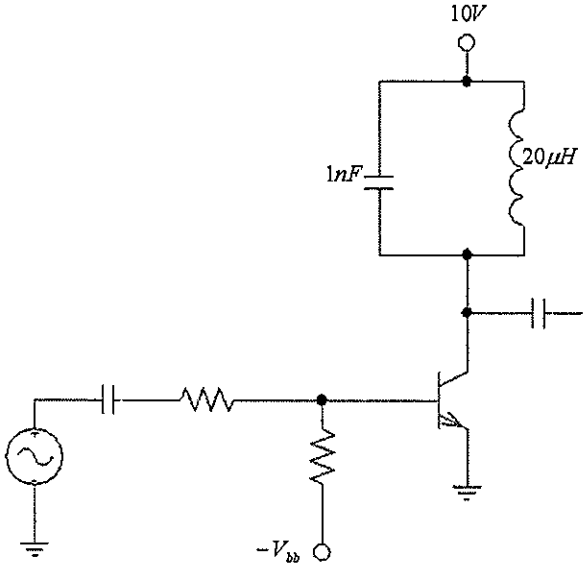

Figure 4

(i) Identify the type of the amplifier (1 mark)

(ii) Calculate the resonant frequency. (2 marks)

(iii) If the coil has a resistance of 15Ω , find the quality (Q) value. (2 marks)

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(b) Figure 5 shows an output waveform of an amplifier.

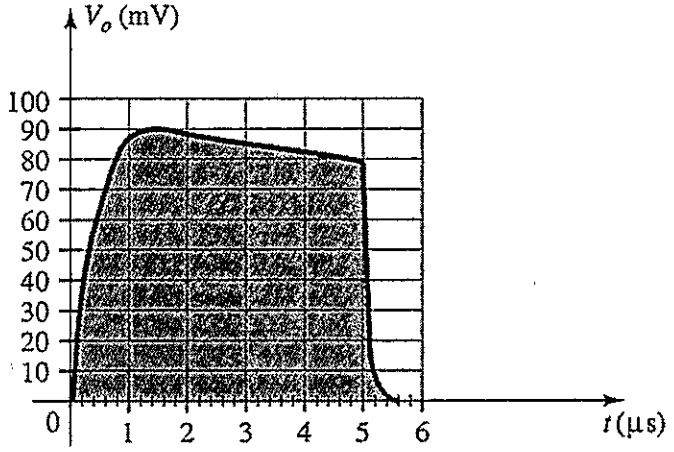

Figure 5

The input of the amplifier is a 20mV, 180kHz square wave signal. Based on Figure 5, calculate the following parameters:

(i) Upper cutoff frequency (5 marks)

(ii) Lower cutoff frequency (4 marks)

(c) Figure 6 shows an astable multivibrator using a 555 IC which produces 5 kHz output with 85% duty cycle. Assume C_1 = 100 nF. Determine the following:

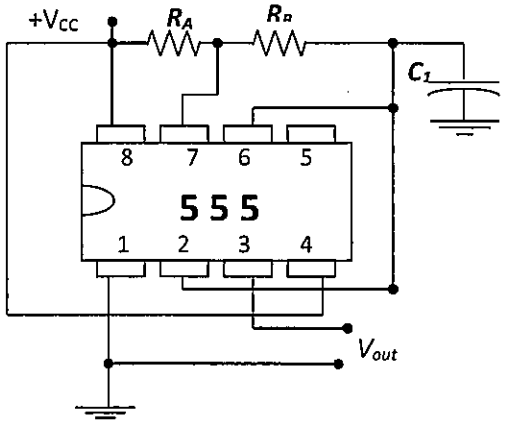

Figure 6

(i) R_A and R_B (7 marks)

(ii) Based on the answer in (i), calculate the pulse width and space width. (4 marks)

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